

Caldwell, Bruce

Working Paper

F. A. Hayek and the Economic Calculus

CHOPE Working Paper, No. 2015-08

Provided in Cooperation with:

Center for the History of Political Economy at Duke University

Suggested Citation: Caldwell, Bruce (2015) : F. A. Hayek and the Economic Calculus, CHOPE Working Paper, No. 2015-08, Duke University, Center for the History of Political Economy (CHOPE), Durham, NC

This Version is available at:

<https://hdl.handle.net/10419/149735>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

F. A. HAYEK AND THE ECONOMIC CALCULUS

BY

BRUCE CALDWELL

CHOPE WORKING PAPER No. 2015-08

AUGUST 2015



F. A. Hayek and the Economic Calculus

Bruce Caldwell

Duke University

Abstract:

The paper offers a revisionist account of certain episodes in the development of F. A. Hayek's thought. It offers a new reading of his 1937 paper, "Economics and Knowledge," that draws on unpublished lecture notes in which he articulated more fully the distinctions he made in the paper between a "pure logic of choice," or the economic calculus, and an "empirical element," which he would later call the competitive market order. Next, the paper shows that Hayek continued to try to develop his ideas about the role of the economic calculus through the 1950s and early 1960s, an effort that has been missed because it never led to any published work. Finally, the paper examines Hayek's attempt to articulate a theory of the market process, one that would be at the same level of generality as the economic calculus, in lectures he gave at the University of Virginia. He never developed a full-fledged formal theory, but his failed efforts still bore fruit in leading him to his contributions on spontaneous orders and the (verbal) theory of complex phenomena. This work anticipated contributions by others who were more technically trained.

Keywords: F. A. Hayek, the economic calculus, market process, the pure logic of choice, the structure of economic theory, spontaneous orders

F. A. Hayek and the Economic Calculus¹

Bruce Caldwell

Introduction

This paper offers a revisionist account of certain important episodes in the development of Friedrich Hayek's thought. It begins with an examination of the methodological framework that Hayek introduced in his 1937 paper "Economics and Knowledge" in which he distinguishes between a tautological "pure logic of choice" and an "empirical element" that deals with "the investigation of causal processes." That framework has been little remarked upon, partly because the standard interpretation focuses on other important aspects of the article, and partly because Hayek's presentation of his methodological views is decidedly opaque.² To elucidate the framework, we will examine some unpublished lecture notes that he developed a few years later in which he explained his views with greater clarity.

Understanding Hayek's methodological approach will help us to clarify certain interpretive issues. It will, in the first instance, allow us better to understand the arguments of "Economics and Knowledge," a difficult article that contains a number of ambiguous passages.

¹ Earlier variants of this paper under different titles were presented in a number of venues. These include a conference on Hayek and the Liberal Tradition at the University of Richmond, the LSE Historical and Philosophical Perspectives Seminar, the European Society for the History of Economic Thought conference (London), the History of Recent Economics conference (Cergy, France), a conference celebrating the 70th birthday of Viktor Vanberg (Freiburg), the NYU Colloquium on Market Institutions and Economic Processes, the George Mason University PPE Workshop, and the Southern Economic Association meetings (Tampa). Peter Boettke, Richard Ebeling, Andrew Farrant, David Harper, Israel Kirzner, Hansjoerg Klausinger, Stefan Kolev, Paul Lewis, Adam Martin, Craig Smith, Roy Weintraub, Larry White, and two anonymous referees provided particularly helpful comments. I offer this paper in memory of Hayek's host in 1961 at the University of Virginia and fellow Nobel Laureate, James Buchanan (1919-2013). Permission to quote from unpublished material was granted by the estate of F. A. Hayek.

² The only paper I know of that discusses this aspect of Hayek's methodological thought is Kirzner 1979. Kirzner there criticizes the framework from a Misesian perspective: by relying on a Robbinsian maximizer in his description of the logic of choice, Hayek fails to integrate the role of acting man, or *homo agens*, into the analysis of the market process.

Next, it will lead to a revision of the claim that Hayek largely stopped doing economics after 1945 or so. In the standard narrative, it was then that he turned his attention towards such fields as psychology and philosophy of mind, intellectual history, political philosophy, and methodology of the social sciences. Hayek only returned to economics in the late 1960s, when he became interested again in business cycle issues and particularly the problem of inflation. I will show, to the contrary, that though there was little evidence of this in his published work, from the late 1940s and throughout the 1950s Hayek had in fact tried to write a book that would be based on ideas he had first articulated in “Economics and Knowledge.” He had not stopped working on economics after all; the work just never led to any publications.

Finally, it will help us better to understand the relationship between Hayek’s writings on complex, adaptive structured orders (spontaneous orders, as he would put it) and his work in economics. Though the claim that a free market economy is an example of such an order was made very early by Hayek, usually after invoking Scottish enlightenment precursors like Hume, Smith, Josiah Tucker, and Adam Ferguson, or the Austrian Carl Menger (see, e.g., Hayek [1933] 1991, pp. 26-28; [1945] 2010, pp. 52-54), few details were ever provided in his early work beyond the assertion. When he began writing explicitly about complex orders in papers like “Degrees of Explanation” ([1955] 2014), “The Theory of Complex Phenomena” ([1964] 2014), and “Notes on the Evolution of Systems of Rules of Conduct” ([1967] 2014), he would mention economics but concentrated on other fields: linguistics, cybernetics, general systems theory, psychology, and communication theory. When he provided an example, it was the Darwinian theory of evolution.³ This is curious given that economics was the field that had initially

³ When dealing with complex phenomena, our ability to predict is limited, and often the best we can do is to explain the principles by which such phenomena operate. Thus with evolutionary theory, we can explain the principle by which it operates (i.e., “a mechanism of reduplication with transmittable variations and competitive selection” Hayek [1964] 2014, p. 32), but we cannot make precise predictions, we cannot predict the course of speciation. The closest we can come regarding prediction is to make a “pattern prediction,” one that rules out certain changes.

stimulated his interest in the topic. Making use of only recently published lectures that he gave at the University of Virginia in spring 1961 (Hayek [1961] 2014), I will show both how Hayek conceptualized the connections between economics and complex orders, and also why he chose not to make the connections more explicit in his published work in the 1950s and 1960s. Though the connections are there in later work, even then it is anything but explicit: indeed, this is what led Karen Vaughn (1999a) to label her own attempt to tease out his ideas “Hayek’s Implicit Economics.”

In the concluding section I will speculate on how early Hayek began to have his insights about complex orders; it may have been very early indeed.

Hayek’s “Economics and Knowledge”

As with so many things Hayekian, it all begins with Hayek’s 1936 presidential address before the London Economic Club, “Economics and Knowledge,” which he published in *Economica* in 1937 (Hayek [1937] 2014). Hayek himself remarked on numerous occasions that it was a seminal piece.⁴

⁴ Perhaps the first time was in lectures he gave to undergraduates at Cambridge during World War II, notes for which include the statement that the paper was “the only *original* contribution to economics I have in my own opinion ever made, although even there, of course, I have done no more than to make explicit what was implicit in other people’s reasoning” (emphasis in the original). Interestingly, this statement is crossed through in the notes, but Hayek would later again refer to the paper as a key contribution. Thus in 1965 he wrote,

Though at one time a very pure and narrow economic theorist, I was led from technical economics into all kinds of questions usually regarded as philosophical. When I look back, it seems to have all begun, nearly thirty years ago, with an essay on “Economics and Knowledge” in which I examined what seemed to me some of the central difficulties of pure economic theory (Hayek [1965] 2014, pp. 49-50).

Hayek also mentions “Economics and Knowledge” in interviews he sat for in the late 1970s.

...it was really the beginning of my looking at things in a new light. If you asked me, I would say that up till that moment I was developing conventional ideas. With the ’37 lecture to the Economics Club in London, my Presidential Address, which is “Economics and Knowledge,” I started my own way of thinking.

A standard interpretation of the role of the article in the development of Hayek's thought is that, via his critique of the static equilibrium theory of the day, Hayek introduced "the knowledge problem," a problem he would solve in his later and more famous paper, "The Use of Knowledge in Society."⁵ A brief review of this interpretation is in order before proceeding.

"Economics and Knowledge" is about the assumptions that economists make in their models about the knowledge that agents are presumed to possess, and the implications that this has for equilibrium analysis. Hayek asserts that the notion of equilibrium has a clear meaning when applied to an individual: the agent is assumed to have a plan, and to know her own tastes and preferences and constraints, and if these are all known and do not change, the choice made is simply a matter of logic.⁶ When one discusses equilibrium for a society, however, one enters into a wholly different sphere. For society to be in equilibrium, the plans of all the agents must be compatible with one another. The usual assumption made about knowledge in equilibrium theory – namely, that all agents have access to the same, correct information – automatically brings about such compatibility, in which all expectations are met. But if agents have access to different bits of knowledge – if knowledge is "divided," as Hayek put it – then how does such a compatibility, how can equilibrium, ever come about? We may talk about a "tendency towards equilibrium," but such talk is meaningless unless we can shed some light on how the coordination of plans takes place. This is the essence of "the knowledge problem." Hayek states that its solution will require further analysis of the *kinds* of knowledge

And it was with a feeling of sudden illumination, sudden enlightenment, that I ---- I wrote that lecture in a certain excitement. I was aware that I was putting down things which were fairly well known in a new form, and perhaps it was the most exciting moment in my career when I saw it in print (Hayek 1983, pp. 425-26).

⁵ See, e.g., Caldwell 1988; 2004, chapter 10, and citations therein.

⁶ Of course, if the agent was wrong about some element of the plan, the choice may bring new knowledge, and hence plan revision.

that are relevant for agents to possess, the *conditions* under which people are likely to acquire such knowledge, and the *process* by which they do so.

Hayek answers these questions in “The Use of Knowledge in Society.” Regarding *kinds* of knowledge, Hayek argues that it is not scientific knowledge, but rather, “knowledge of the particular circumstances of time and place” that individual market participants possess that matters most.

The shipper who earns his living from using otherwise empty or half-filled journeys of tramp-steamers, or the estate agent whose whole knowledge is almost exclusively one of temporary opportunities, or the *arbitrageur* who gains from local differences of commodity prices – are all performing eminently useful functions based on special knowledge of circumstances of the fleeting moment not known to others (Hayek [1945], 2014, p. 96).

The knowledge of the “man on the spot” is therefore critical. But there is an additional problem, that of “communicating to him such further information as he needs to fit his decisions into the whole pattern of changes of the larger economic system” (ibid, p. 98). Luckily, it is not necessary that he knows everything about all the other markets that might affect him. The ever-changing relative scarcities of goods in such markets are reflected in the ever-changing array of market prices that he faces, as Hayek demonstrates with his celebrated “tin example.” The *conditions* and *process* by which knowledge is acquired is through participation in a competitive market process. The price system thus conceived is a vast communication system (ibid., p. 100).

Hayek’s 1946 Stafford Little lecture, “The Meaning of Competition” (Hayek [1948], 2014), is a companion piece, for in it Hayek argues that the theory of perfect competition used by economists fundamentally fails to capture the rivalrous competition that exists in the real world

that brings about social coordination. It fails precisely because it assumes “that a state of affairs already to exist which...the process of competition tends to bring about (or to approximate)” (Hayek [1948] 2014, p. 105). Competition is itself the process that allows market participants both to gain and to transmit knowledge about market conditions through space and time.

Some decades later Hayek would complete his contributions to the knowledge problem with the publication of “Competition as a Discovery Procedure” (Hayek [1978] 2014). In that paper he compares market competition to the scientific method, asserting that both result in the discovery of facts that are not aimed for because no one knows in advance what will be discovered. The sort of knowledge that is revealed through the market process “consists of a capacity to find out particular circumstances,” perhaps the most important of which concerns the relative scarcity of various sorts of resources and goods: “...which goods are scarce goods, or which things are goods, and how scarce or valuable they are—these are precisely the things which competition has to discover” (ibid., p. 306).

That “Economics and Knowledge” was the beginning of this avenue of research is evident. But less noticed is the methodological distinction that Hayek draws in the article between two sorts of analysis. On the one hand there is the “Pure Logic of Choice,” or “formal analysis,” which he describes as a set of tautologies, a “series of propositions which are necessarily true because they are merely transformations of the assumptions from which we start and which constitute the main content of equilibrium analysis” ([1937] 2014, pp. 58-59). Hayek states that much recent formalization in economics consists simply in extending this sort of analysis. But, he insists, it is important to keep these efforts separate “from another element that has been too much neglected,” the investigation of what he calls “causal processes”:

In distilling from our reasoning about the facts of economic life those parts which are truly *a priori*, we not only isolate one element of our reasoning as a sort of Pure Logic of Choice in all its purity but we also isolate, and emphasize the importance of, another element which has been too much neglected. My criticism of the recent tendencies to make economic theory more and more formal is not that they have gone too far but that they have not yet been carried far enough to complete the isolation of this branch of logic and to restore to its rightful place the investigation of causal processes, using formal economic theory as a tool in the same way as mathematics (ibid., p. 59).

Let us probe further into Hayek's delineation of two different sorts of analysis. The first, more formal, analysis he sometimes calls the Pure Logic of Choice, and other times equilibrium analysis, and he describes it as tautological and as comparable to a tool. It is not altogether clear, however, what it comprises. Is it, for example restricted to consumer choice theory, as the phrasing might suggest, or is it to be conceived more broadly to include any sort of analysis that involves "equilibrium theorizing"? Next, whatever he might have meant by the Pure Logic of Choice, his point is that there is another part of economics that involves "the investigation of causal processes." Hayek not only insists that the latter must be kept separate from the formal analysis of the Pure Logic of Choice, but that it needs to be restored to its "rightful place." This suggests that it has existed before and been somehow displaced. But (at least in "Economics and Knowledge") he declines to tell us what it is; only later do we find out that it is what would become called "market process analysis." Nor does he tell us how such analysis is to be carried out, except by way of issuing a rather strange prohibition: though "the empirical element in economic theory...consists of propositions about the acquisition of knowledge" (ibid., p. 57),

...in stressing the nature of the empirical propositions of which we must make use if the formal apparatus of equilibrium analysis is to serve for an explanation of the real world, and in emphasizing that the propositions about how people will learn, which are relevant

in this connection, are of a fundamentally different nature from those of formal analysis, I do not mean to suggest that there opens here and now a wide field for empirical research. I very much doubt whether such investigation would teach us anything new (ibid., p. 77).

In short, the article raises as many questions as it answers.⁷ Luckily, many of the questions are answered in a set of unpublished undergraduate lectures that he delivered in Cambridge a few years later.

The Cambridge Lectures and the Economic Calculus

The London School of Economics (LSE), where Hayek then taught, was evacuated to Cambridge when World War II started, eventually setting up in two properties owned by one of the Cambridge colleges, Peterhouse. The notes from one of his courses, “Economic Analysis,” which he delivered during the 1943-44 academic year, survive.⁸ It is basically a course in microeconomics. They are one of only two sets of notes in English that Hayek preserved, so he must have thought them important.⁹ Many of the topics Hayek covered would be familiar to

⁷ I am sometimes asked what single article one should read to better understand Hayek. Even though Hayek himself thought that “Economics and Knowledge” was fundamental, its many ambiguities have led me over the years to recommend “The Use of Knowledge in Society” instead.

⁸ Hayek Collection, box 138, folder 10. The lecture notes are written out and run to over 100 pages. The pages are not numbered, so quotations in the text and footnotes will not make reference to a page. The two pages in which he introduces the economic calculus are done with a flourish (the title is capitalized, centered, and underlined twice) and appear to have been rewritten and inserted in a later (1945/46) academic year. It seems that Hayek wanted to restate the points that he made there with particular emphasis.

A referee noted that the “Economic Analysis” course had been given by Lionel Robbins at the LSE in the 1930s (and in Cambridge in 1939/40), and that while Robbins followed the conventional ordering of topics he too distinguished between “simple economy” and “complex economy” from time to time.

⁹ The only other set of notes in English that I have located were from Hayek’s “Development of Economics II” class, a history of economic thought course on the post-Smithian classical period. These included fairly detailed mini-biographies of major and minor figures, lists of the works they had written (including the more obscure titles), many of these typed out with handwritten supplementary material added. He probably kept these as much for

anyone who has taught introductory microeconomics. In the first (Michaelmas) term, he handled the theory of production and consumer choice; in the second (Lent), market exchange and market structures; and in the third (Summer), the theory of distribution. Many of his diagrams would also be familiar.

But some of the diagrams decidedly are not. And as he admits to the students in his opening lecture, his decision to present the theory of production before consumer choice theory is also “rather unusual.” In discussing why he is approaching the course in what might seem an idiosyncratic way, Hayek introduces a new term, “the economic calculus,” and shows how it fits into our understanding of economic phenomena. He tells the students that “the economic calculus” is just another term for the “pure logic of choice,” the phrase that he had used in “Economics and Knowledge”; he also sometimes calls it “the theory of simple economy.”¹⁰ The economic calculus is used to analyze the actions that follow from a single coherent plan. The plan may be that of an individual, a firm, a community, a nation, and so on. The two prime examples of the economic calculus that he will deal with are the theory of production and the theory of consumer choice. (He notes that capital theory could also be included, but because of its difficulty, he will not say much about it.) When employing the economic calculus one can deduce, logically, what will happen in a given choice situation because of the key assumption that “all the data are always facts that are given to the individual.”

Another way of thinking about the economic calculus is that it analyses the various ways that means-ends relationships may be structured: “In a way all the economic calculus is

their value as a research reference as for class notes. See the Hayek Collection, box 139, folder 6. Notes from courses he taught in German may be found in the Hayek Collection, box 139, folders 11 and 12.

¹⁰ In the lectures he would give at Virginia Hayek explained *why* he preferred “economic calculus” to “pure logic of choice.” “Choice” can occur when there is no scarcity: a person deciding which jewelry to wear for a night out, or a surgeon deciding which scalpel is best for a particular operation, each makes choices, but there is no economic side to it. *Economic* calculation requires scarcity of means to accomplish chosen ends (Hayek [1961] 2014, pp. 389-90).

concerned with is the classification of goods according to their economically relevant characteristics; not concerned with their physical characteristics but with position in the means-end order.” The means-ends structures reveal the economically relevant characteristics of objects. At one point Hayek promises that the classification system will be an exhaustive one.¹¹ He presents production theory before the theory of consumer choice (which is the opposite of the usual order in a standard microeconomics class) because in that application, choices about the best means (factors of production) to obtain a given end (output) present a more concrete example of a specific means-ends structure.

Before putting up the familiar sorts of diagrams that are associated with production theory (e.g., total, marginal, and average product curves; isoquants), Hayek draws some diagrams that are meant to reveal the “General structure of means-ends relationship.” He represents situations in which there are many ends and one means; one end and multiple possible means; multiple means and ends; means that are substitutes and complements; means that can only be used for a particular purpose; ends that themselves are means into another choice situation, and so on. Here are some examples.

[Insert picture]

Hayek will use these pictures again, in lectures at the University of Virginia. The rest of the Michaelmas term was devoted to explicating the theories of production and consumer choice, for the most part using, if not always standard, at least recognizable diagrams.¹²

¹¹ “In brief the purpose of this economic calculus is no more than to provide an exhaustive classification of the objects of economic activity according to their economically relevant attributes....” Cambridge Lectures, Hayek Collection, box 138, folder 10.

¹² Some of the diagrams are not used today, and Hayek was not always careful in labeling his axes, but one can still see what he was doing.

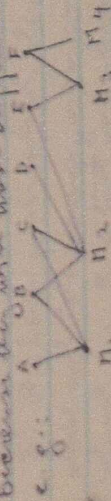
General structure of income-end, relationship:
 1 means with alternative uses: A, B, C, D
 conversion of 1 as source of income fund
 all equally capable of same use

and ends as capable of being
 subjected to various degrees



counterpart for given end, example of
 being satisfied by using different means
 these means can, as we see later, either be
 perfect substitutes with regard to their ends, and
 therefore wanted only alternatively,
 or strictly complementary, wanted immediately in fixed proportions,
 or, most likely, in variable proportions, being imperfect substitutes.

why should we regard all means which are perfect substitutes with
 regard to A as different?
 because they will have different alternative uses



although each means only is limited use
 and though none (e.g. M_1 & M_4) cannot be used at all for some ends
 they still form part of same unmodelled system.

e.g. necessity of M_1 may have effect that M_3 will have
 to be used differently, because M_2 has to replace M_1

simple expansion of what is meant by interdependence of whole
 economic system

could consider of our given living to deal with two
 separate systems, different economic system, if neither was
 of the means in one group will be available for other
 (not likely in fact because at least two factors will change in economy)
 but useful to consider



This sort of scheme representation does not get us very far

In his opening lecture for the Lent Term, Hayek made clear how the topics in the economic calculus that had been explored in the first term were going to fit in with what was to come, the study of “multiple economy,” in which the plans of many individuals interact. His introductory remarks are worth quoting at length:

In describing the decisions of an individual from the desires and the knowledge presumed to be possessed by him we were merely making explicit a conclusion implied in our assumptions. We were playing at pure logic – that is why I called it the Logic of Choice...or the Economic Calculus. No questions of cause and effect arose in this sphere; the relations with which we dealt were all of that “tautological” character which mathematics or logic have, and had nothing to do with the way in which events follow each other in time and affect each other.

Now we shall, of course, still be using this technique insofar as we have to deal with any of the separate plans of the different individuals. But as these plans are separate and not necessarily known to the other individuals, as soon as the people begin to act upon them, a new and different problem arises.

In a multiple economy dealings with other people will necessarily form part of the plans of each individual. But he will not know beforehand what the other people intend to do, and will learn this only as time goes on. Every such experience he will have, if it is not precisely what he has expected, is a new datum to him. Once we assume he has learnt a new fact, we can then derive his reaction from the new datum (to him) and all the other facts. But with his learning about **new facts** which may possibly lead him to alter his plan, we meet for the first time a true **cause** bringing about a change. If he learns the new fact, the rest just follows from our assumptions. But in assuming he does learn about it we bring in a new empirical assumption (emphases in the original).

In discussing interaction in situations in which there are multiple agents, then, we must take into account the learning that takes place. Hayek speaks next of the confusion that results from using an equilibrium approach, as is the case with the theory of perfect competition, for describing that process:

It is important that from the beginning we look at **competition not as a state** of affairs in which everybody knows everything but as a **process** by which knowledge is dispersed and acquired – how effectively this happens under different conditions we shall gradually see (emphases in the original).¹³

The introductory lectures with which Hayek began the Michaelmas and Lent terms were methodological clarifications for how to view the theoretical structures that were about to be presented. The economic calculus is that part of standard microeconomics that deals with the optimal allocation of resources; it is optimization theory. It is constructed on the assumption that a plan exists and that the decision-maker has all the information necessary to pursue the plan. Given that these assumptions are met, the derivations that follow are simply exercises in logic.

If we ask how the decision-maker comes to learn that information, we introduce a new empirical assumption, one that involves causes and causal processes. Agents find out new information as they interact with one another in competitive markets. As an illustration, we might consider the way that Hayek put it in his 1940 critique of the market socialist Oskar Lange's claim that socialist managers could be instructed to set prices so as to reflect minimum costs:

¹³ Both Hansjoerg Klausinger and a referee pointed out that Hayek's phrase "everybody knows everything" is not a good characterization. In standard theory, as Klausinger pointed out, "what the individual firm needs to know is just its own technology (i.e. cost curves) and the market price, all the knowledge about e.g. consumer preferences and other firms' technologies is embodied in the market price, so that the individual firm is not required e.g. to know the cost curves of the others." This is correct, but Hayek's actual claim, as will be shown in the quote to follow in the text, is that in a competitive environment of constant change, firms do not in fact know things like their own cost curves.

...the question is frequently treated as if the cost curves were objectively given facts. What is forgotten here is that the method which under given conditions is the cheapest is a thing which has to be discovered, and to be discovered anew sometimes almost from day to day, by the entrepreneur, and that, in spite of the strong inducement, it is by no means regularly the established entrepreneur, the man in charge of the existing plant, who will discover what is the best method. The force which in a competitive society brings about the reduction of price to the lowest cost at which the quantity salable at that cost can be produced is the opportunity for anybody who knows a cheaper method to come in at his own risk and to attract customers by underbidding the other producers (Hayek [1940] 1997, p. 130).

Hayek's sharp division in the Cambridge lectures between the economic calculus and the process of market competition allows us to make better sense of certain ideas that he expressed in "Economics and Knowledge."

The market process plays a causal role in Hayek's vision of how a market economy works: it continually generates new information, which causes people to adjust their actions, which provides new information to others, who adjust their actions, and so on. Crucially, the theory of perfect competition, with its focus on equilibrium end states, obscures this vital role. It is for this reason that Hayek asks in "Economics and Knowledge" (and later, and more explicitly, in "The Meaning of Competition") that we "restore to its rightful place" a theory of market process. "Restore" is the right word, and a significant one: as a number of authors have pointed out, members of the classical school offered verbal descriptions of the competitive market

process quite similar to the vision that Hayek had enunciated, one that was quite different from the theory of perfect competition that emerged later.¹⁴

What about Hayek's apparently paradoxical caveat in "Economics and Knowledge" that the "empirical element in economic theory" is probably not best investigated using empirical techniques? Hayek's admonition may have been a simple pre-emptive move, aimed at people like Wesley Clair Mitchell and the American institutionalists who were, indeed, calling for more empirical investigations in economics, and who claimed that such studies would eventually lead to a new theory.¹⁵ The Austrians had long opposed the view that there was an inductive path to theory formation, having frequently criticized it in their debates with the German Historical School and, more recently, with positivists.¹⁶ But Hayek may also have hoped that something more was possible, namely, a *theory* of the of the competitive market process as an information generating, processing, and distributing mechanism that was comparable in scientific rigor to the theoretical treatment that had been developed for the economic calculus. Whether or not he saw that possibility then, Hayek would wrestle with precisely that question in the years to come.

Hayek's Turning Away from Economics – A Revisionist View

Archival evidence suggests that, far from turning away from economics, from the late 1940s onwards Hayek was in fact planning to do more in the field. And apparently much of this

¹⁴ See e.g., Kirzner [1960] 1976, chapter 4; Machovec 1995. Boettke's 2012 distinction between "mainline" versus "mainstream" economics gets at the same issue more broadly.

¹⁵ Hayek came to know Mitchell, and indeed sat in on his classes, when he came to the US in 1923-25. He and his LSE colleague Lionel Robbins criticized institutionalism in subsequent writings: see, e.g., Robbins 1935, p. 83: "The only difference between Institutionalism and *Historicism* is that *Historicism* is much more interesting." Chapter one of Hayek's *Monetary Theory and the Trade Cycle* (Hayek [1933] 2012) also contains an implicit criticism of Mitchell.

¹⁶ See Caldwell 2004 chapter 3-5, 9 for more on these issues.

planned work focused on further application of the notion of the economic calculus. His path, though, was anything but easy.

Thus in an exchange of letters with John Nef in fall 1948 Hayek outlined some of the projects he would undertake if he gained an appointment on the Committee on Social Thought at the University of Chicago, a prospect that was then under discussion. One of the projects had to do with economics: “I have still a good deal to say on economics proper, particularly in connection with more recent ‘Keynesian’ developments and on what I like to call the logic of choice or the economic calculus.”¹⁷ A few years later, it appears that he was planning to write a book, one that was to be titled *A Grammar of the Economic Calculus*.¹⁸ We may infer this from the picture that he sketched of its cover, complete with date and publisher information!¹⁹

[Insert book cover picture here]

Hayek began teaching at Chicago in fall 1950. In October 1951 he wrote to his friend the philosopher Karl Popper that he had spent part of the previous summer collecting materials and ideas for the “Grammar of the Economic Calculus” project.²⁰ The project is mentioned again in 1955 and in 1959, in two items labeled “Memorandum for Plans of Work” that he prepared for the Volker Fund.²¹ In the earlier memo it looks like he envisaged a book aimed at an educated

¹⁷ Both letters may be found in the Hayek Collection, box 55, folder 1.

¹⁸ Roy Weintraub offered a conjecture for the origin of the book’s title: it may have been modeled on Karl Pearson’s popular book, *The Grammar of Science* (1949).

¹⁹ The book cover may be found in the Hayek Collection, box 129, folder 5.

²⁰ F. A. Hayek to Karl Popper, 7 October 1951, the Popper Collection, Hoover Institution Archives, box 305, folder 14.

²¹ The terms of his appointment on the Committee included the provision that the William Volker Charities Fund would reimburse the University of Chicago for the amount of his salary for a period of ten years. The memoranda Hayek prepared were to inform the Volker Fund trustees of his planned work. They may be found in the Hayek Collection, box 93, folder 11.

ORIGINAL COPY, NOT TO BE REPRODUCED
8 LINES TO INCH
TRADE MARK, REG. U.S. PAT. OFF.

A GRAMMAR OF THE ECONOMIC CALCULUS

BY
F. A. HAYEK

1952

University of Chicago Press, Chicago
Routledge & Kegan Paul, London

audience. But it also appears that he was having some trouble with it; indeed, he left mentioning it until the very end of the document.

Finally, I do hope not completely to abandon my work on technical economics. I had long thought that the next book in that field would be “A Grammar of the Economic Calculus” – a sort of rigorous introduction into the basic logic of economics intended mainly for scientists and people with a scientifically trained mind. But although I have collected a good deal of material for this, it still proves very refractory to shaping in a book...²²

Hayek noted that another project, a popular book on money titled “Money as an Intellectual Adventure” and for which he had “a fairly clear outline” might need to come first.²³ In 1959, though, he wanted to combine the two economics projects into one:

I intend in the first instance to try and combine the two economic studies mentioned...in the earlier memorandum in a volume to be called *A New Look at Economic Theory*. This would hardly provide the rigorous introduction into the basic logic of economics which I then contemplated but merely an outline of the economic calculus followed by an examination of the working of the money economy.

Thus for over a decade Hayek kept thinking about writing a book, but could not decide exactly what he wanted to do with it. He finally moved beyond the collection of notes and the tossing around of ideas when he was invited by James Buchanan to give a series of lectures to be held in spring 1961 at the University of Virginia. Hayek decided to title the lectures *A New*

²² Some of the material he collected may be found in his notes in the Hayek Collection, box 129, folders 5 and 6. Topics and problems to be covered included such things as economics and engineering, choice, equivalence, and opportunity cost, as well as their “Corresponding Fallacies,” among them objective value, energetics, and the just price.

²³ I have not been able to locate the outline that Hayek mentions.

Look at Economic Theory, and to devote one of them to an exposition of the economic calculus. He would finally have to put his ideas down on paper in a coherent form.

Hayek discussed what he hoped to do in the lectures in another letter to Karl Popper, written the year before he was to give them. The letter is significant because in it we can see yet *another* change of plans. Now Hayek wanted to restate his ideas on the nature of economic theory using “the conception of higher level regularities,” an idea that he felt would be “fruitful far beyond the field of economics.” He went on to say,

I suspect it is really what Bertalanffy with his General Systems Theory was after and the conception itself was of course already implied in my “Degrees of Explanation.” It continues to become clearer, though I have not yet got an altogether satisfactory formulation of what I am after.²⁴

Hayek mentions his 1955 paper “Degrees of Explanation.” This was where he first started distinguishing sciences that study simple from those that study complex phenomena, and began to reference such people as Warren Weaver (who had discussed problems of “organized complexity”), the philosopher and mathematician Norbert Wiener (a founder of cybernetics), and his own friend Ludwig Bertalanffy, as well as such areas as evolutionary biology, communication theory, linguistics, and (John von Neumann’s) theory of automata as all being concerned with complex systems.²⁵ These were ideas that he hoped to develop further.

So in his final formulation, it looks like Hayek hoped to integrate some of his more philosophical work on complex phenomena, research that had begun to occupy him in the

²⁴ Letter, Hayek to Popper, 27 February 1960, Hayek Collection, box 44, folder 2. A founder of general systems theory, the Austrian-born biologist Ludwig Bertalanffy (1901-1972) was a friend of Hayek’s, and had offered him comments on *The Sensory Order* when it was in manuscript form.

²⁵ Regarding von Neumann, Hayek said: “I met John von Neumann at a party, and to my amazement and delight, he immediately understood what I was doing and said that he was working on the same problem from the same angle. At the time his research on automata came out, it was too abstract for me to relate it to psychology, so I really couldn’t profit from it; but I did see that we had been thinking on very similar lines” (Hayek 1982, p. 322).

1950s, with his earlier-formed ideas on the nature of economic theory. That was the formidable task that he set for himself in Charlottesville. Once again, he would not succeed.

*The Virginia Lectures: An Overview with Commentary*²⁶

Though James Buchanan had seen Hayek speak at the University of Chicago in 1946 when Buchanan was still a graduate student, it was not until the summer of 1955 that they appear to have had their first real period of interaction, this at a Volker Fund seminar at Wabash College, Indiana. That apparently led to an invitation to Buchanan to attend the 1957 Mont Pèlerin Society meeting in St. Moritz. In 1959 they both gave lectures at another Volker Fund seminar on political economy, held at UNC-Chapel Hill and hosted by the monetary economist Clarence Philbrook,²⁷ and the next year came the invitation to Virginia. The Virginia lectures were sponsored by the newly-established, and later controversy-ridden, Thomas Jefferson Center for Studies in Political Economy and Social Philosophy.²⁸

The first lecture takes as its topic, “The Objects of Economic Theory.” Hayek’s initial important claim is that many economic phenomena are in fact examples of organized but undesigned complex orders. What is the best way to theorize about such phenomena? Hayek proposes that we reflect on the approach taken by microeconomics. This will be helpful not only because “the exact scientific character of the older micro-analysis was always a little obscure,” but also because of his hope that “certain aspects of the technique of analysis of microeconomic

²⁶ The lectures have now been published; see Hayek [1961] 2014.

²⁷ For details, see Buchanan 1992. A personal aside: I was in graduate school at UNC in the 1970s, and was a student in the last graduate class that Clarence Philbrook taught, in spring 1976. The class consisted in its entirety of us doing close readings of two books, Keynes’ *General Theory* (Keynes 1936) and Don Patinkin’s *Money, Interest and Prices* (Patinkin 1965). On the first day Philbrook said, while holding up Keynes’ book, “It has been said that no book has ever been written that does not contain at least some truth. This one may be the exception.”

²⁸ For more on the controversies surrounding the Center, see Buchanan, 1988.

theory should apply also in other fields which deal with phenomena of comparable complexity” (Hayek [1961] 2014, p. 375). He mentions biology and psychology as two fields parts of which also deal with such phenomena. So Hayek thought that the approach taken in microeconomics might shed light on (or perhaps even provide a model for the study of) other fields that deal with complex phenomena.

The patterns exhibited by complex orders are typically abstract, and when dealing with them scientists often must employ abstract schemata, such as those provided by mathematics. The recurring patterns that exist in society are particularly hard to identify, so that often the best we can do is to identify patterns that may involve relations, or relations among relations (and so on to higher levels), of elements, rather than specifying their detailed interactions. For example, mathematical economists have described the behavior of a market system using systems of equations. These are of no help in making precise predictions; at best they merely illustrate structures of relations or provide explanations of the principle by which the phenomena behave. But that is not something to worry about; we should simply accept the fact that precise prediction is impossible when dealing with complex orders. Indeed, we should avoid the temptation that we can do more: “the pretence to more knowledge than we possess or can obtain has certain dangerous consequences” (ibid., p. 386).

In the second part of the lecture Hayek states that the role of the economic calculus is to provide an abstract, deductive method for describing or classifying the sort of orders or structures that we sometimes see in economic phenomena in the real world.²⁹ Recognizing the existence of the order is important, for though it was not designed by men, it is essential for realization of human ends. Market interaction may under certain conditions bring about at least an approach to such an order. But the economic calculus can tell us nothing about how that

²⁹ Hayek [1961] 2014, p. 383: “Much of what we know as the pure theory of utility and of production indeed proves on closer inspection to be no more than such a logical scheme, a description of a significant type of order which, once we know it, we then can indeed discover to exist in the real world.”

happens or what those conditions are. To give “an account of the causal mechanism which produces the order is clearly the task for an empirical science and can never be solved by the deductive methods of pure logic” (ibid., p. 384).

In this lecture, then, Hayek tries to link up his earlier writings and thoughts on the economic calculus and the market process to his then developing work on the study of phenomena of organized complexity, just as he had told Popper he would do. He continues to insist that we must keep the economic calculus separate from our account of the workings of the “causal mechanism” that drives the market process. But he makes two new claims, both important. First, the market process is just one example of the sort of mechanisms that are studied by other sciences: economics is not alone in its study of such phenomena. Second, its workings can give rise to structures of relations in the world, structures that are described by the economic calculus. The second claim is truly novel. The economic calculus is a tool, but also, to the extent that the competitive market process is working, it has *ontological standing: it represents and reflects orders that may be found in the social world*. This is why he suggests that the approach taken in economics might serve as a model for other sciences.³⁰

We can mention in passing that reference to a pretence of knowledge appears not once but three times in this lecture. The phrase “pretence of knowledge” also appears in the notes Hayek made for his book on the economic calculus. That phrase would finally find its way into print as the title of Hayek’s Nobel lecture (Hayek [1975] 2014), though there he would apply it primarily to issues of macroeconomics.

³⁰ This may help to explain Hayek’s ambivalent remarks in later work about the systems of equations associated with general equilibrium theory. He would typically praise these as representing certain structures of relationships that could exist in the world, while at the same time warning that we should avoid the temptation of trying to use them to calculate prices and quantities for the economy (see, e.g., Hayek 1964 [2014] pp. 269-71; 1975 [2014], pp. 366-67).

The next two lectures may be read together: in one he describes the economic calculus in some detail, and in the next he applies it to a policy issue. Hayek draws the same diagrams that he did at Cambridge to illustrate the general structure of the connections between means and ends. When one ranks the different ends quantitatively, one moves to the more familiar diagrams of production and utility theory, which he then dutifully reproduced on the board.³¹

We can note as an aside that Buchanan's book with Gordon Tullock, *The Calculus of Consent*, was published the year after Hayek had given his lectures. Buchanan and Tullock use the term "calculus" in much the same way as Hayek, to denote optimizing behavior (albeit in the political arena). The diagram on the cover of their book also intrigues, given its similarity to the ones that Hayek had drawn to illustrate possible relationships between ends and means, but their use of it is quite different.³²

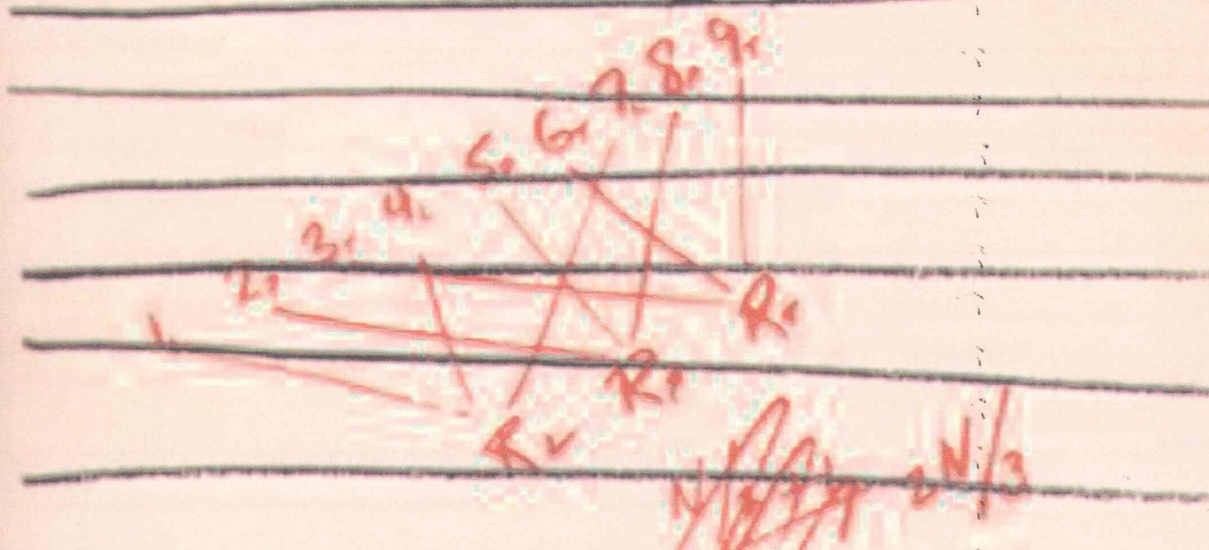
[insert picture of book cover]

Hayek states that his first interest in the economic calculus was sparked by considering the difference between people he considered to be good economists and those (either economists or people in other fields) who seemed not to understand economic reasoning. The difference, he came to believe, was that good economists shared "a capacity of discovering and refuting certain kinds of fallacies of reasoning" (Hayek [1961] 2014, p. 388).³³ He wonders aloud, can the reasoning that allows them to do this be taught? If so it would be very valuable,

³¹ This must have been deadly for the audience: as he commented more than once, the diagrams would be boring to someone who had taken a class in economics, and incomprehensible to those who had not.

³² So far I have not found any documents to explain how Buchanan and Tullock came up with the name of their book. The diagram on the cover is used in the book (Buchanan and Tullock [1962] 1999, p. 231) to represent three interests (viz., Labor, Property, and Trade) each supplying three votes to elect a representative in one house of a bi-cameral legislature.

³³ The view is consistent with that of the Chicago economist Henry Simons, who said in his economics syllabus, "Economics is primarily useful, both to a student and to the political leader, as a prophylactic against popular fallacies" (Simons 1983, p. 3).



James M. Buchanan & Gordon Tullock

the calculus of consent

LOGICAL FOUNDATIONS OF CONSTITUTIONAL DEMOCRACY

AA100  Ann Arbor Paperbacks

because fallacies in reasoning by well-intentioned people cause them to make costly policy errors, for example, by viewing as examples of obvious waste developments that economists would see as the normal workings of the system. This was presumably what Hayek had in mind in his 1955 memorandum when he described a book on the economic calculus that would be a “sort of rigorous introduction into the basic logic of economics intended mainly for scientists and people with a scientifically trained mind.”

The economic calculus, then, is a useful tool for helping economists and others think clearly about the relationships between means and ends. Hayek demonstrates this by criticizing his old nemesis Otto Neurath’s proposal that a central planning board should forgo market prices and use *in natura* calculation instead.³⁴ Neurath’s recommended approach ignores the importance of the framework of the economic calculus for making rational decisions about resource allocation:

If we remember that as recently as thirty years ago it was contended by serious thinkers that the phenomenon of value was peculiar to the capitalist organization of society and that socialist society would be able to dispense with it by relying entirely on what was called calculation “in natura” or in real terms, it is rather remarkable that this contention can be so clearly disproved by a purely deductive argument (ibid, p. 401).

From Hayek’s perspective, Neurath’s mistake was evident: he failed to think like an economist.

In the third lecture Hayek applies the economic calculus in a discussion of the use of technology and its relation to policy decisions in less developed countries. He starts from the obvious point that the economic conditions facing the developed nations of the West (conditions that determine the best uses of capital and labor resources there) differ from those that less developed countries face. He notes next that different sorts of technology are appropriate to

³⁴ For more on Neurath, Hayek, and socialist planning, see Boettke 2000; Caldwell 2004, pp. 113-17, 424-30; Hayek [1952] 2010, chapters 5, 10.

different sorts of economic conditions. As such, efforts by certain less developed countries to mimic the West, efforts that are often supported by policy advisors from developed countries who have little appreciation for local conditions, inevitably result in a waste of resources. Concretely, less developed countries typically have a relative surplus of labor and a relative scarcity of capital when compared to developed ones. Under such conditions, to pour resources into the construction of state-of-the-art factories is wasteful. As Hayek put it, "...better ploughs and carts and draft animals and farm buildings and not combines or even tractors will probably be what is needed" (ibid., p. 214).

In his example Hayek is using simple means-ends reasoning that is very familiar to economists, who might use the terms opportunity cost and comparative advantage. If what he says seems obvious today, it was perhaps less so when he was writing. One of the people he cites in the lecture is C. P. Snow, who in his widely-read book *The Two Cultures* had claimed that all China and other less developed countries needed to do to catch up with the west was to have us train more Chinese scientists and engineers (Snow [1959] 1998, p. 44ff).³⁵

Hayek's final lecture is titled "The Communication Function of the Market." In "The Use of Knowledge in Society" Hayek had chosen the market for tin to illustrate how freely adjusting market prices allow plan coordination. He provides a similar though more detailed example in the Virginia lecture, one involving an American string manufacturer who begins substituting sisal for jute, not due to any change in demand for string or in the production of sisal or jute, but to

³⁵ Snow writes (pp. 44-45): "It is simply that technology is rather easy.... For the task of totally industrializing a major country, as in China today, it only takes will to train enough scientists and engineers and technicians. Will, and quite a small number of years." In his book detailing the often unfortunate outcomes when Western "experts" gave advice to developing countries, William Easterly (2013) begins by imagining a "debate that never happened" between Hayek and Gunnar Myrdal on development, and laments that Myrdal's ideas dominated development theory and practice for much of the post-war period.

more remote circumstances that nevertheless affect him.³⁶ The point of the example is that the American string manufacturer is not likely to be informed about changes in markets that are far removed from his own. But he does not have to be. All he needs to know is that the price of jute went up relative to sisal, and that causes him to adjust his plans “in the right direction.” The constant process of adjustment is what gives rise to a structure in the world, a set of relationships that approximates the structure of the economic calculus. Though it is a world of constant change and adjustment, there is a tendency to move in the appropriate direction (Hayek [1961] 2014, pp. 416-17).

In the rest of the lecture, Hayek addresses other aspects of the knowledge problem. He notes that in addition to prices, a market participant generally must know a host of other things: the social and legal framework of the society in which she lives, technological possibilities, and the particular circumstances of the environment, which would include the people with whom one is interacting (ibid., p. 418). As regards prices, things become very difficult theoretically when one realizes that current prices are much less important than expected future prices: if prices go up, do people expect them to come back down, keep going up, or stabilize at the new higher level, and can anything be said in general about that?³⁷ The numbers of people participating in

³⁶ These might be, for example, a reduction in Indian grain imports that then reduces the available return shipping space for jute, driving up its shipping costs, or perhaps the fact that some other industry had substituted artificial fibers for sisal. See Hayek [1961] 2014, pp. 416-17. Note that this example makes Hayek’s point more explicitly than the tin example had: here he explicitly emphasizes that things can happen that affect a business but that are far removed from anything that a manufacturer might be keeping tabs on. Notwithstanding their ignorance, the price system helps the business owners to make the appropriate adjustments.

³⁷ This was a point that Ludwig Lachmann, the radical subjectivist who chastised Mises and Hayek for failing to incorporate subjectivism into the analysis of expectations, repeatedly made; see, e.g., Lachmann 1976. It implies that the speed of adjustment in specific markets is an empirical question about which very little may be said theoretically. Hayek seems to be acknowledging the point in his discussion.

the market also evidently has effects, but it is difficult to define how dense the network must be to work well, though generally, the more, the better.³⁸

These are all interesting questions. But Hayek does not provide what was supposed to have been his main contribution, a new theoretical framework. At the end of the lecture he admits as much, though he tempers his admission with the thought that perhaps it is not possible to do much more:

But I have not only not succeeded in working out such a more precise theory but have also become rather doubtful whether there is much more to be said and whether the taking account of this process of the communication of knowledge does not necessarily mean a sort of retreat from the kind of precision achieved by a theory based on the assumption of given and perfect knowledge to something inevitably more vague and indefinite. This may be very disturbing to some people, but I am not sure whether this retreat from pseudo-precision does not in fact bring a gain in realism and usefulness....The only point I feel unhappy about is that, though even an imprecise answer might be very valuable, the chance of persuading others that so far as it goes it is right, and therefore that it will in fact be used as a guide for political action, is very small (ibid., pp. 422-23).

His statement above probably is what caused James Buchanan, Hayek's host at Virginia, later to reflect on the talks as follows:

These lectures were failures, at least by Professor Hayek's own standards. Those who listened to them were, of course, rewarded by a careful review of the earlier analysis of knowledge in relation to economic interaction. But Hayek was unable to go beyond that

³⁸E.g., "...what seems necessary is that there should exist a sufficiently pervasive inter-connection by each seller knowing a number of buyers which are also known to other sellers which in turn know other buyers and so on" (Hayek [1961] 2014, p. 418).

which he had developed two decades before; no new insights emerged as he reviewed the earlier thought processes. His announced ambitions were thwarted (Buchanan 1992, p. 131).

Having reviewed the Virginia lectures, it should be evident why Hayek never developed his ideas about complex orders in economics more formally.³⁹ As his diagrams make painfully evident, he simply did not have the mathematical background to do so. Now, to avoid making anachronistic judgments, it must be pointed out that, at the time he was writing, neither did most other economists. It was scholars in other fields who first began to develop the formal apparatus for dealing with complex systems. To his credit, towards the end of his working career Hayek was in contact with some of them. Barkley Rosser (1999, p. 185, note 11) notes that Hayek “had significant communication with both Ilya Prigogine and Hermann Haken, respectively the founders of the Brussels and Stuttgart schools.” Milan Zeleny of Columbia University invited him to a symposium on autopoiesis, dissipative structures and spontaneous social orders held in January 1979, but Hayek did not attend. Another invitation to a conference on complex systems came in 1985, but health problems precluded his attending.⁴⁰

Since his death there have been considerable advances in these areas. Scholars at places like the Santa Fe Institute have acknowledged the close ties of their work to that of people like Hayek.⁴¹ Whether a full-fledged theory of the market process will ever be developed

³⁹ Never letting work go to waste, Hayek did put some of his ideas from the third and fourth Virginia lecture into another paper first published in the late 1960s, “Competition as a Discovery Procedure” (Hayek [1978] 2014). And as noted earlier he used the phrase “The Pretence of Knowledge” as the title for his Nobel address (Hayek [1975] 2014).

⁴⁰ For details see Caldwell 2004, p. 362.

⁴¹ As Brian Arthur once said in an interview, “Right after we published our first findings, we started getting letters from all over the country saying, ‘You know, all you guys have done is rediscover Austrian economics.’ ...I admit I

by scholars now laboring in such areas as agent-based modeling or simulation studies remains to be seen.⁴² Meanwhile, those who seek to extend Hayek's work within the Austrian community have gone in another direction, namely, exploring from a variety of perspectives the sets of institutions that must accompany a market order in order for it to function properly.⁴³

As for Hayek himself, throughout the 1960s and 1970s he continued to investigate complex adaptive orders in a variety of areas, from scientific fields like linguistics, psychology, and evolutionary biology, to applications in such areas as the evolution of legal, social, and moral traditions. His myriad investigations allowed Hayek to make a number of contributions to a general verbal theory of spontaneously-forming, adaptive complex orders.⁴⁴ But a formal theory of market processes eluded him.

Concluding Remarks

I will close with some highly speculative musings about the role of the economic calculus in Hayek's *oeuvre*. One of Hayek's most interesting and provocative claims made in the Virginia lectures is that the economic calculus may be viewed not just as a tool, but as a structure that

wasn't familiar with Hayek and von Mises at the time. But now that I've read them, I can see that this is essentially true" (Arthur, quoted in Vaughn, 1999b, p. 241).

⁴² See, e.g., Epstein and Axtell, 1996; Miller 1996; Kochugovindan and Vriend, 1998; Rosser 1999; Vriend, 2002; Durlauf 2005; Markose 2005; Foster, 2005; Axtell 2005, 2007.

⁴³ One sees this, for example, in work on "robust political economy" undertaken by Boettke and Leeson, 2004, and Pennington, 2011, or in explorations of the relevance of "the Bloomington School" (led by Elinor and Vincent Ostrom) in Aligica and Boettke 2009. Vaughn 1999a was an important call to arms for such new approaches.

⁴⁴ Some representative contributions that incorporate applications from other sciences are Hayek [1964] 2014 and [1969] 2014; [1967] 2014 is perhaps his best general treatment. Interestingly, not just themes but whole passages from the Hayek's first Virginia lecture appear in "The Theory of Complex Phenomena." That paper was first published in 1964 in a *Festschrift* for Karl Popper, but as he notes in its first footnote (Hayek [1964] 2014, p. 257), he "completed the manuscript in December 1961", that is, within about half a year of giving the lectures.

reflects things we perceive in the world. This concern with the relationship between the world and the abstract structures we use to theorize about it has resonances elsewhere in his work.

Recall that in his Cambridge lectures Hayek claimed that the economic calculus would provide “an exhaustive classification of the objects of economic activity,” of the means-ends structure. The words “exhaustive” and “classification” resonate. In “The Facts of the Social Sciences,” written around the same time as the Cambridge lectures, Hayek asserts that in trying to make sense of the behavior of others, we use a classification system based on our knowledge of our own mind:

...we can derive from the knowledge of our own mind in an ‘*a priori*’ or ‘deductive’ or ‘analytic’ fashion, an (at least in principle) *exhaustive* classification of all the possible forms of intelligible behavior (Hayek [1943] 2014, p. 86, emphasis in the original).

After the war Hayek took seven years to turn what started out as a paper (“What Is Mind?”) into his 1952 book on psychology, *The Sensory Order*. In that book Hayek described the brain as an immensely complicated, inter-connected and hierarchical classification system. In the concluding chapter of the book, where Hayek explores the “Philosophical Consequences” of his work, he asserts that the classifying system that will continue to adjust its relations until “in the end the system of explicit definitions becomes both all-comprehensive and self-contained or circular” (Hayek 1952, p. 171), that is to say, exhaustive. I must confess I never really understood these and similar passages in Hayek’s writings about exhaustive classifying systems that allow us to interpret reality. But it would seem that as early as 1943 Hayek was beginning to see analogies between the structure of the brain and the ways that we structure our own understanding of the economic system, and indeed other complex systems.

By the early 1950s he was trying further to develop these hypotheses. The theme of the fragment “Within Systems and About Systems,” for example, is that the human brain is a

hierarchical system that interacts with other similar systems in a larger system (the economy).⁴⁵

That paper remained unfinished. Another, titled “The Causal Determination of Purposive Action,” apparently was never started.⁴⁶ By the late 1950s it appears that Hayek began to realize that he simply lacked the mathematical background to formalize his ideas within psychology. He then tried to express them within economics, in the Virginia lectures, again with at best limited success. Ultimately, he decided to express his ideas verbally by identifying a variety of fields that studied complex orders, and from which he drew conclusions about their characteristics.

All of this may explain why Hayek would in the early 1950s create an aspirational book cover that featured prominently the economic calculus. It is hard to imagine him doing that for what would be a popular book about common fallacies. It is easier to imagine him doing it for a book that would reveal commonalities in theorizing about such different entities as the brain and the workings of the economy.

But there is more. This was not Hayek’s only book cover. He also made one for a psychology paper that he wrote as a student at the University of Vienna, one he completed in September 1920. The paper detailed how our consciousness of a stimulus occurs when it can be entered into a previously developed system of connections, and spoke of “connections of different strengths” in a “structural network,” of an “ordering of impressions” and “an order of sensory events,” concluding that “From a psychological point of view, it is this system of

⁴⁵The manuscript may be found in the Hayek Collection, box 104, folder 22.

⁴⁶ Hayek promised a paper of that title to Gottfried Haberler, with the idea that he would present it before the Unity of Science group at Harvard in May 1957. The dates did not work out and as far as I can tell the paper was never written. See Hayek’s letters of 23 February, 19 May, and 15 October 1957 in the Haberler Collection, box 16, folder “Hayek.”

Das Bewusstsein betrachtet alles Geschehen als
ein einheitliches Sein, eine kontinuierliche Folge
von Wirkungen, die uns in der Erfahrung gegeben
ist.

Die empirische begründete Definition
des Begriffes Materie ist: Mit Materie bezeichnen
wir jedes denkbare Zusammenbestehen von
Wirkungen auf uns und auf die Umgebung (also
wieder auf Materie). Wenn letzteren erkennen wir
durch die durch sie hervorgerufenen, neu aufzufassenden
Wirkungen des Wirkungs-komplexes Umgebung
auf uns (Materie) und sind dabei auch die
nämlich wahrgenommen Teile des, Ich's enthalten.
Das Sein ist gleiches, ein einheitliches Sein, einheitliche Materie
in Einheit mit der Reihe der Wirkungen.
"Bewusstsein als Schicksalsspiel, ist wirklisches
und Geschick, die Schicksalsspiel - Zeit".
Zurück der Menschheit ist die (geistige) Aufmerksamkeit
physischen Wirkungen bezogen, ist fortzusetzen.

Versuch einer Theorie

der
ENTWICKLUNG

des
MENSCHLICHEN BEWUSSTSEIN

Versuch einer Theorie

der

ENTWICKLUNG

des

MENSCHLICHEN BEWUSSTSEIN

relationships that constitutes consciousness.” As he notes in his preface to the book, that student paper provided the starting point for *The Sensory Order*.⁴⁷

[insert picture of cover]

References

Aligica, Paul Dragos, and Boettke, Peter. 2009. *Challenging Institutional Development and Analysis: The Bloomington School*. London: Routledge.

Axtell, Robert. 2005. “The Complexity of Exchange,” *Economic Journal*, vol. 115, June, pp. F193-F210.

_____. 2007. “What Economic Agents Do: How Cognition and Interaction Lead to Emergence and Complexity,” *Review of Austrian Economics*, vol. 20, pp. 105-22.

Boettke, Peter. 2012. *Living Economics: Yesterday, Today, and Tomorrow*. Oakland, CA: The Independent Institute.

Boettke, Peter, ed. 2000. *Socialism and the Market: The Socialist Calculation Debate Revisited*. 9 volumes. London: Routledge.

Boettke, Peter and Leeson, Peter. 2004. “Liberalism, Socialism, and Robust Political Economy,” *Journal of Markets and Morality*, vol. 7, Spring, pp. 99-111.

⁴⁷ The notebook in which the book cover appears may be found in the Hayek Collection, box 139, folder 5.

Buchanan, James. 1988. "Political Economy: 1957-1982." In *Ideas, Their Origins, and Their Consequences: Lectures to Commemorate the Life and Work of G. Warren Nutter*. Washington, DC: American Enterprise Institute, pp. 115-30.

_____. 1992. "I Did Not Call Him 'Fritz': Personal Recollections of Professor F. A. v. Hayek," *Constitutional Political Economy*, vol. 3, pp. 129-35.

Buchanan, James, and Tullock, Gordon. [1962] 1999. *The Calculus of Consent: Logical Foundations of Constitutional Democracy*. Indianapolis, IN: Liberty Fund.

Caldwell, Bruce. 1988. "Hayek's Transformation," *History of Political Economy*, vol. 20, Winter, pp. 513-41.

_____. 2004. *Hayek's Challenge: An Intellectual Biography of F. A. Hayek*. Chicago: University of Chicago Press.

Durlauf, Stephen. 2005. "Complexity and Empirical Economics," *Economic Journal*, vol. 115, June, pp. F225-F243.

Easterly, William. 2013. *The Tyranny of Experts: Economists, Dictators, and the Forgotten Rights of the Poor*. New York: Basic Books.

Epstein, Joshua, and Axtell, Robert. 1996. *Growing Artificial Societies: Social Science from the Bottom Up*. Boston: MIT Press.

Foster, John. 2005. "From Simplistic to Complex Systems in Economics," *Cambridge Journal of Economics*, vol. 29, pp. 873-92.

Hayek, F. A. [1933] 1991. "The Trend of Economic Thinking." Reprinted in *The Trend of Economic Thinking: Essays on Political Economists and Economic History*, edited by W. W.

Bartley III and Stephen Kresge, vol. 3 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 1.

_____. [1933] 2012. *Monetary Theory and the Trade Cycle*. Reprinted in *Business Cycles, Part I*, edited by Hansjoerg Klausinger, vol. 7 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge.

_____. [1937] 2014. "Economics and Knowledge." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 1.

_____. [1940] 1997. "Socialist Calculation: The Competitive 'Solution'." Reprinted in *Socialism and War: Essays, Documents, Reviews*, edited by Bruce Caldwell, vol. 10 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 3.

_____. [1943] 2014. "The Facts of the Social Sciences." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 2.

_____. [1945] 2010. "Individualism: True and False." Reprinted in *Studies on the Abuse and Decline of Reason: Texts and Documents*, edited by Bruce Caldwell, vol. 13 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge.

_____. [1945] 2014. "The Use of Knowledge in Society." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 3.

_____. [1948] 2014. "The Meaning of Competition." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 4.

_____. 1952. *The Sensory Order*. Chicago: University of Chicago Press.

_____. [1952] 2010. "Scientism and the Study of Society." Reprinted in *Studies on the Abuse and Decline of Reason: Texts and Documents*, edited by Bruce Caldwell, vol. 13 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge.

_____. [1955] 2014. "Degrees of Explanation." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 6.

_____. [1961] 2014. "A New Look at Economic Theory." In *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, Appendix.

_____. [1964] 2014. "The Theory of Complex Phenomena." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 9.

_____. [1965] 2014. "Kinds of Rationalism." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, Prologue.

_____. [1967] 2014. "Notes on the Evolution of Systems of Rules of Conduct." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 10.

_____. [1969] 2012. "Three Elucidations of the Ricardo Effect." Reprinted in *Business Cycles: Part II*, edited by Hansjoerg Klausinger, vol. 8 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 11.

_____. [1969] 2014. "The Primacy of the Abstract." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 13.

_____. [1975] 2014. "The Pretence of Knowledge." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 16.

_____. [1978] 2014. "Competition as a Discovery Procedure." Reprinted in *The Market and Other Orders*, edited by Bruce Caldwell, vol. 15 of *The Collected Works of F. A. Hayek*. Chicago: University of Chicago Press, and London: Routledge, chapter 12.

_____. 1982. "Discussion." In *Cognition and the Symbolic Processes*, vol. 2, edited by Walter Weimer and David Palermo. Hillsdale, NJ: Erlbaum, pp. 287-93.

_____. 1983. "Nobel Prize Winning Economist." Edited by Armen Alchian. UCLA, Charles E. Young Research Library, Department of Special Collections, Oral History Transcript no. 300/224. Transcript of an interview conducted in 1978 under the auspices of the Oral History Program, University Library, UCLA. © Regents of the University of California.

Keynes, John Maynard. 1936. *The General Theory of Employment, Interest, and Money*. London: Macmillan.

Kirzner, Israel. [1960] 1976. *The Economic Point of View: An Essay in the History of Economic Thought*. Kansas City: Sheed and Ward, Inc.

_____. 1979. "Hayek, Knowledge, and Market Process," in *Perception, Opportunity, and Profit: Studies in the Theory of Entrepreneurship*. Chicago: University of Chicago Press, pp. 13-33.

_____. Kochugovindan, Sreekala, and Vriend, Nicolaas. 1998. "Is the Study of Complex Adaptive Systems Going to Solve the Mystery of Adam Smith's 'Invisible Hand'?" *The Independent Review*, Summer, pp. 53-66.

Lachmann, Ludwig. 1976. "From Mises to Shackle: An Essay on Austrian Economics and the Kaleidic Society," *Journal of Economic Literature*, vol. 14, March, pp. 54-62.

Machovec, Frank. 1995. *Perfect Competition and the Transformation of Economics*. London and New York: Routledge.

Markose, Sheri. 2005. "Computability and Evolutionary Complexity: Markets as Complex Adaptive Systems (CAS)," *Economic Journal*, vol. 115, June, pp. F159-F192.

Miller, Mark. 1996. "Review of John Holland, *Hidden Order: How Adaptation Builds Complexity*," *Reason*, vol. 28, December, p. 59.

Patinkin, Don. 1965. *Money, Interest, and Prices: An Integration of Monetary and Value Theory*. 2nd. ed. New York: Harper and Row.

Pearson, Karl. 1949. *The Grammar of Science*. London: Dent.

Rosser, J Barkley. 1999. "On the Complexity of Complex Economic Dynamics," *Journal of Economic Perspectives*, vol. 13, pp. 169-92.

Simons, Henry C. 1983. *Simons' Syllabus*, Gordon Tullock, ed. Fairfax, VA: Center for the Study of Public Choice.

Snow, C. P. [1959] 1998. *The Two Cultures and the Scientific Revolution*. Cambridge: Cambridge University Press.

Vaughn, Karen. 1999a. "Hayek's Implicit Economics: Rules and the Problem of Order," *Review of Austrian Economics*, vol. 11, pp. 129-44.

_____. 1999b. "Hayek's Theory of the Market Order as an Instance of the Theory of Complex Adaptive Systems," *Journal des économistes and des études humaines*, vol. 9, June September, pp. 241-56.

Vriend, Nicolaas. 2002. "Was Hayek an Ace?" *Southern Economic Journal*, vol. 68 (4), pp. 811-40.